Energy

INTRODUCTION

- Metabolism: totality of organism's chemical reactions from interactions between molecules
- Catabolic and anabolic pathways change metabolism
    - Catabolic pathway: pathway that releases energy by breaking down complex molecules
    - Anabolic pathway: pathway that consumes energy to build complicated molecules from simpler ones
    - Bioenergetics is the study of how energy flows through living organisms and applied by catabolic and anabolic pathways

ENERGY

- Energy is the capacity to cause change and can be used to do work
    - Kinetic energy: energy related w/ relative motion of objects
    - Heat: thermal kinetic energy associated w/ random movement of atoms or molecules
    - Potential energy: energy that matter possesses b/c of its location of structure
    - Potential chemical energy: potential energy available for release in chemical reaction
- Potential chemical energy is converted to kinetic chemical energy in the body from food to movement
- Thermodynamics: study of energy transformations in collection of matter
    - The 1st Law of Thermodynamics states that the energy in the universe is constant; therefore, it cannot be created/destroyed but only transformed
    - The 2nd Law of Thermodynamics states that every energy transfer or transformation increases the entropy of the universe
    - Entropy: measure of disorder
- Free energy: portion of system's energy that can perform work and temperature and pressure are uniformed throughout the system

EQUILIBRIUM

- Equilibrium describes a state of maximum stability
- Spontaneous reactions and nonspontaneous reactions are chemical reactions that assist in achieving equilibrium
    - Spontaneous reaction: releases free energy from system and makes it more stable
    - Nonspontaneous reaction: increases total energy of system and makes it less stable
- Exergonic/exothermic and endergonic/endothermic reactions are similar to spontaneous and nonspontaneous reactions
    - Exergonic/exothermic reaction: net release of free energy, ΔG is negative and is spontaneous
    - Endergonic/endothermic reaction: absorbs free energy; ΔG is positive and is nonspontaneous
- However, living cells are never at equilibrium because there is a constant flow of material in/out of the cell
- Metabolic disequilibrium is still important because a cell stops all cellular work when it reaches metabolic disequilibrium